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CHUM SALMON RESOURCES OF ALASKA FROM BRISTOL BAY TO POINT HOPE

by

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CONTENTS

	Page
Introduction	1
Bristol Bay region	3
Ugashik River	3
Egegik River	3
Naknek River	5
Kvichak River	6
Nushagak River	6
Togiak River	6
Cape Newenham to the Kuskokwim River	6
Kuskokwim River	6
Coastal area from Kuskokwim to Yukon River	13
Yukon River	15
Yukon River to Seward Peninsula	19
Seward Peninsula from Koyuk to Buckland	19
Buckland to Point Hope	20
Offshore Islands	21
Summary	21
Literature cited	21

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ABSTRACT

A literature survey was conducted to determine the importance and utilization of chum salmon, *Oncorhynchus keta,* from Bristol Bay to Point Hope, Alaska. This species is the most abundant and economically important to the welfare of the local residents within this vast area, except for the Bristol Bay area where sockeye salmon, *Oncorhynchus nerka,* far outnumber chum salmon. The Yukon River system produces the greatest number of chum salmon of all the areas covered here, with catches ranging from 500,000 to nearly 1,000,000 fish annually. The Kuskokwim River system follows, with annual catches averaging over 500,000. Ranking third in production is the Bristol Bay area where commercial catches range as high as 400,000. The rivers and streams entering Kotzebue Sound from the base of Seward Peninsula northwest to Point Hope rank fourth in importance, annual catches being estimated in excess of 264,000.

INTRODUCTION

Although chum salmon *(Oncorhynchus keta)* are the most abundant species in the rivers and streams ranging north from Bristol Bay and extending as far east as the Mackenzie River in Canada (fig. 1), very few data are available on their abundance in this vast region. Abundance of chum salmon in the Bristol Bay region, where they follow sockeye salmon *(O. nerka)* in importance, can be determined quite accurately for the past several decades from commercial catch records.

Considerable interest in this valuable but biologically unexplored resource has been aroused within the past few years as a result of the intensive Japanese high-seas salmon fishery. Information of a general nature, including distribution in the region and importance in the native economy, has been available for the two major river systems, the Yukon and Kuskokwim. The need for more specific information prompted the Bureau of Commercial Fisheries in Alaska to conduct a reconnaissance survey in 1957 (Raleigh, 1958). Brief surveys were made of many of the salmon rivers and streams between Cape Newenham and Point Hope, but the Yukon River was excluded. A survey of the salmon fisheries of the Yukon River was made, however, during the summer of 1958 (Knapp, 1958).

Figure 1.--Alaska and northwestern Canada.

Earlier information on salmon resources of the Yukon River was reported by Gilbert and O'Malley (1921), by the U.S. Bureau of Fisheries in the reports, Alaska fishery and fur-seal industries from 1919 through 1943; and by the Branch of River Basin Studies, Bureau of Commercial Fisheries, Juneau, Alaska. The River Basin Studies group has prepared several reports in the past few years on the fish and wildlife resources of both the upper and lower Yukon River basins.

The surveys of recent years have been limited in scope, and few biological or statistical data have been collected. The major objectives have been to estimate the numbers of salmon taken by local fishermen for subsistence, and to determine the types and units of fishing gear used in the various areas. Data have been gathered during visits to the many small Eskimo and Indian villages, where local residents were interviewed personally. Identification of the species has often been doubtful. Chum salmon taken on the same day in fish wheels on the Yukon River have ranged from silvery bright to a highly colored calico. To residents with limited knowledge of salmon coloration, salmon with such varying markings were often identified incorrectly as to species.

Data from the several sources mentioned will be discussed in this report in geographical sequence from Bristol Bay to the offshore islands of the Bering Sea.

BRISTOL BAY REGION

Chum salmon rank next to sockeye salmon in the commercial pack of the Bristol Bay region, but are much less abundant. From 1951 to 1959, commercial catches of chum salmon in Bristol Bay rivers ranged from 156,750 to 400,644 fish; the annual average catch was 313,424 (table 1). The Nushagak is the largest producer of chum salmon, followed by the Naknek-Kvichak system (fig. 2). The remainder of the areas produce considerably smaller catches.

The total annual Bristol Bay case pack of chum salmon from 1933 through 1959 is shown in figure 3. The data were obtained from the Pacific Fisherman Yearbook (1959, p. 87[1]) and the files of the Bureau of Commercial Fisheries, Alaska. In recent years production has been low, reducing the average pack for the last 10 years to below the preceding 10. Since escapement data are not available, it is not known whether the case pack is an indicator of annual abundance.

Spawning ground surveys in past years were concentrated on areas utilized by sockeye salmon, and data on chum salmon have been gathered only incidentally. Lack of chum salmon adults in areas of the various weirs and counting tower sites, which were generally located considerable distances up the major salmon rivers, indicates that most chum salmon spawn in the lower reaches of the rivers or in tributary streams entering below these installations.

Chum salmon for personal use of local residents are taken mainly in the Nushagak, Togiak, and Ugashik Rivers. No data are available to indicate how many thousands are taken each year.

Brief comments from personnel of the Bureau of Commercial Fisheries familiar with the Bristol Bay rivers (fig. 2) are presented in the discussion that follows.

Ugashik River

The Ugashik is the southernmost of the Bristol Bay rivers. It is located on the Alaska Peninsula and is of minor importance in chum salmon production. Counts of salmon were made at a weir located immediately below the outlet of the lower Ugashik Lake from 1926 through 1932. Chum salmon counts ranged from 89 in 1927 to a maximum of 1,210 in 1932. Heaviest spawning of this species occurs in Dog Salmon River, although some are found in King Salmon River.

Egegik River

The Egegik is the river outlet to Becharof Lake and is another minor producer of chum

[1] 1958 a year of surprise in Pacific salmon canning. (January) p. 81-127.

Table 1.--Chum salmon catches, Bristol Bay area, 1951-59

Year	River and statistical area number[1]					
	Ugashik (321)	Egegik (322)	Naknek-Kvichak (324)	Nushagak (325)	Togiak (326)	Total
1951	16,843	15,439	38,844	85,624	([2])	156,750
1952	19,651	18,060	93,835	117,875	([2])	249,421
1953	21,027	26,724	212,112	127,483	([2])	387,346
1954	39,384	62,040	138,016	159,852	1,352	400,644
1955	51,286	23,238	39,405	97,521	735	212,185
1956	6,934	16,713	93,841	172,546	25,483	315,517
1957	13,226	12,849	45,620	143,461	44,186	259,342
1958	12,714	12,089	119,324	193,688	20,277	358,092
1959	20,185	29,407	200,458	186,891	44,575	481,516
Mean	22,361	24,062	109,051	142,771	22,768	313,424

[1] Statistical areas are by river systems, and commercial catches are taken off the mouths of these rivers.

[2] No catch records available.

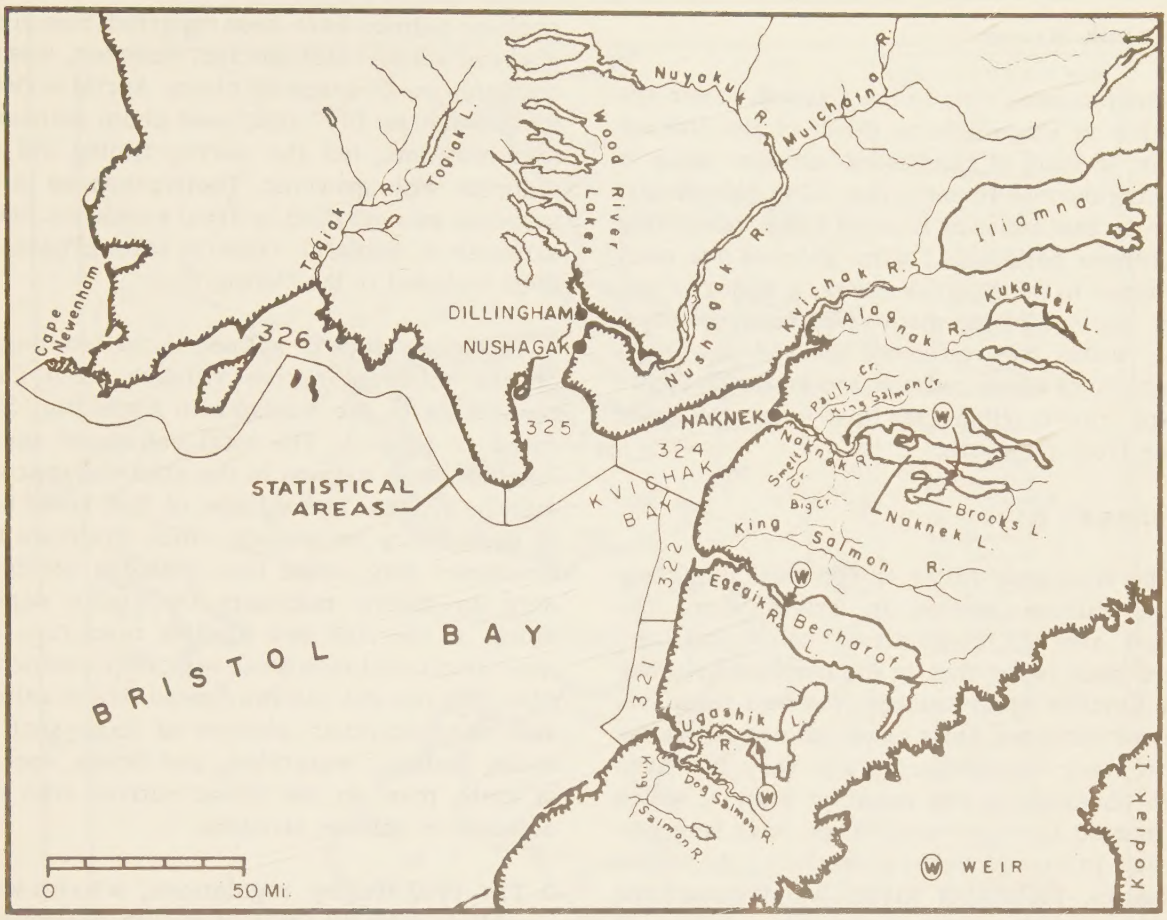

Figure 2.--Important chum salmon rivers within statistical areas of the Bristol Bay region.

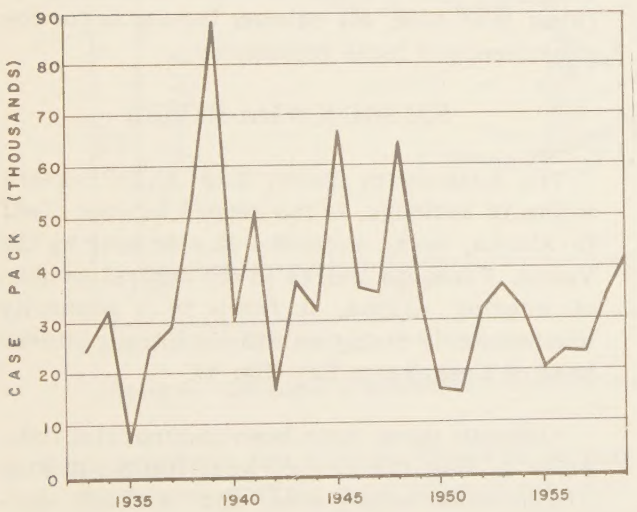

Figure 3.--Annual case pack of chum salmon, Bristol Bay, 1933-59. Data from Pacific Fisherman Yearbook, 1959.)

salmon. Most chum salmon spawn in King Salmon River, the only large tributary of the Egegik. A few chum salmon ascend the stream as far as the former site of a salmon weir, which was located just below Becharof Lake. In 1932 only 210 chum salmon were counted through the weir.

Naknek River

Chum salmon production in the Naknek River is somewhat greater than in the Ugashik and Egegik Rivers. Most chum salmon spawn in Big Creek, although small numbers use the minor tributaries, King Salmon, Smelt, and Pauls Creeks. The numbers that passed the weirs or counting towers on the main stem have been small; a maximum count of 1,044 was recorded in 1929. A few chum salmon have been observed at the Brooks Lake weir.

Kvichak River

Chum salmon runs in the Kvichak River are similar in magnitude to those of the Naknek River. In spite of significant numbers taken in the commercial fishery, few chum salmon appear at the outlet of Iliamna Lake. According to Bureau personnel, chum salmon are most abundant in the Alagnak River, a major tributary that enters the main river from the east, well within the influence of tides. Small numbers of chum salmon are known to spawn in the minor tributaries that enter the main river from the north.

Nushagak River

The Nushagak River is the most important chum salmon stream in Bristol Bay. The annual average commercial catch has been more than twice that of the combined Naknek and Kvichak River catches, the next most important streams. Most chum salmon utilize the main river for spawning, and very few have been observed at the counting station, which is located far upstream. They have been observed in considerable numbers up the major tributary, Mulchatna River, which enters the main stem below the counting site.

Togiak River

Although the Togiak is a minor chum salmon river, it has runs of nearly as many salmon of this species as of sockeye salmon. In recent years, its commercial production has been more than 20,000 chum salmon. Spawning occurs principally in the main river, but the small tributaries are also utilized by chum salmon spawners. Escapements up to 200,000 have been reported by personnel of the Bureau of Commercial Fisheries.

CAPE NEWENHAM TO THE KUSKOKWIM RIVER

The coastal area lying between Cape Newenham and the mouth of the Kuskokwim River contains a number of small rivers and streams (fig. 4). Two of the streams, Kanektok and Eek Rivers, have estimated chum salmon catches in excess of 20,000 (table 2). Chum salmon are known to enter nine of these streams, and sockeye salmon have been reported from eight. Sockeye salmon distribution, however, was not the same in all cases as chum. Aerial surveys by Raleigh in 1957 disclosed chum salmon in four streams, but the survey timing did not coincide with spawning. Their presence in the streams was verified by local residents. Small streams of doubtful value to salmon have not been included in the listing.

The importance of salmon in the food supply of the different native villages from Cape Newenham to the Kuskokwim River (fig. 5) is rated in table 3. The total estimated annual catch of chum salmon in the area was approximately 37,000. The village of Eek rated high in dependency on salmon, while Platinum and Goodnews Bay rated low. Villages inhabited only by native residents invariably depend more on the fish and wildlife resources for their livelihood than those with white residents. Also, the coastal natives depend less on salmon and more on other sources of food, such as seals, beluga, waterfowl, and ocean species of fish, than do the inland natives who live adjacent to salmon streams.

The 1960 fishing regulations, which were established by the State of Alaska Department of Fish and Game, allowed a quota of 25,000 sockeye salmon and a total of 3,000 salmon of all other species to be taken commercially within the mouth of the Kanektok River (fig. 4). Other than this, all salmon fishing is for the subsistence of local residents.

KUSKOKWIM RIVER

The Kuskokwim River, with 22,237 square miles of drainage, is the second largest river in Alaska, being exceeded in size only by the Yukon. From its source in the central section of interior Alaska, it flows in a generally southwesterly direction and discharges into the head of Kuskokwim Bay (fig. 4).

Although there have been commercial fisheries in this river, they were limited to king *(Oncorhynchus tshawytscha)* and sockeye salmon, chum salmon being used in the extensive native personal-use fisheries. The more desirable species were salted, pickled, or dried by small commercial enterprises, but since

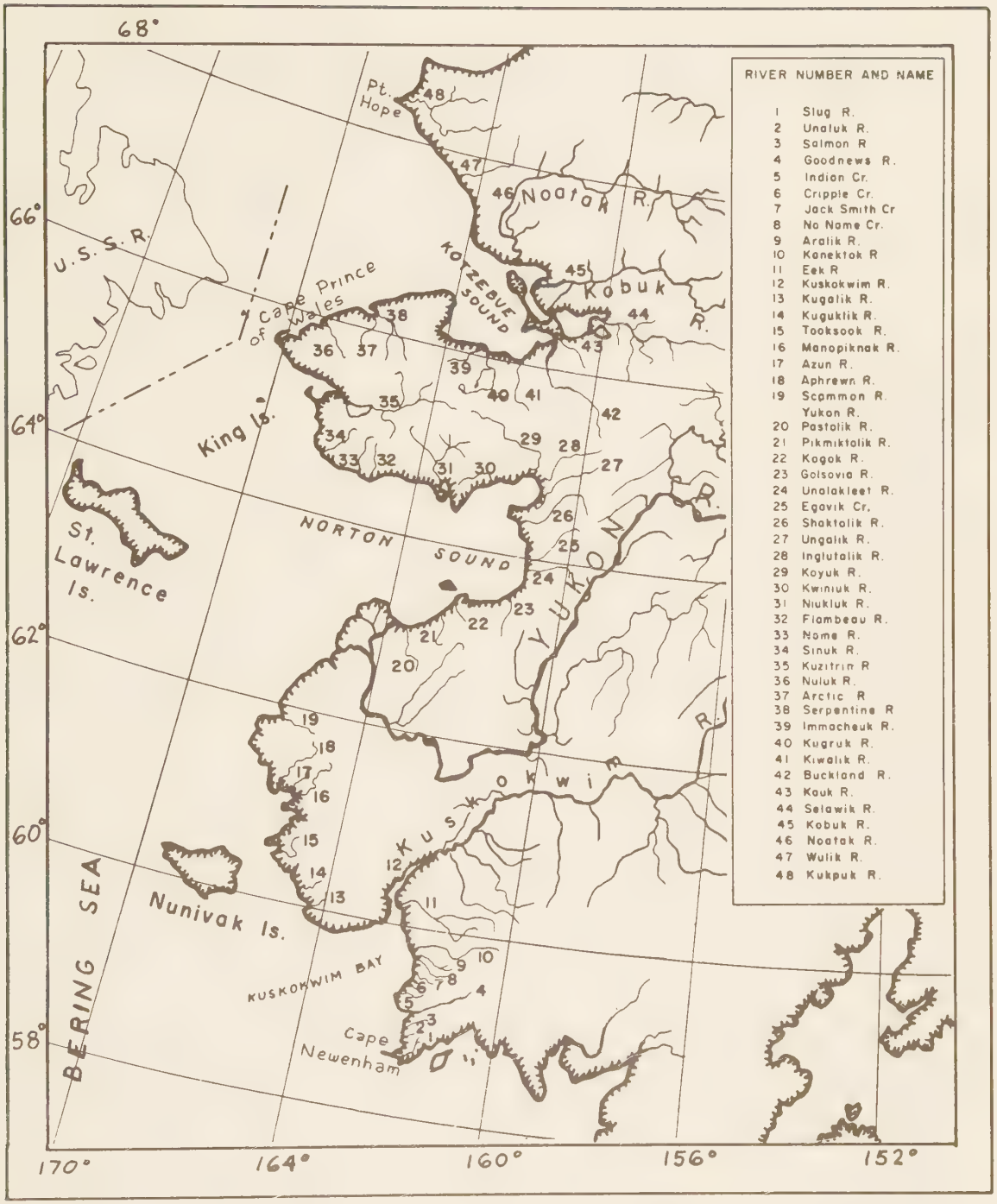

Figure 4.--Locations of productive salmon streams between Cape Newenham and Point Hope, Alaska.

many residents felt that the export of salmon products was working a hardship on the local inhabitants, commercial fishing on the Kuskokwim River was closed in 1925. It was again allowed in 1930 with certain restrictions. In 1931 a quota of 250,000 fish, including sockeye and king salmon, was established for commercial use. Generally this rather lenient quota was not filled by the salteries, but because of the effects of the commercial fishery, local residents again requested a closure of the river. In 1952, the export of salmon from

Table 2.--Species of fish reported by natives from streams between Cape Newenham and Point Hope, Alaska, and estimates of annual salmon catches

Area and stream	Square miles drainage area	Species of fish utilized																Recent annual salmon catches
		Whitefish	Sheefish	Dolly Varden	Rainbow trout	Lake trout	Burbot[1]	Pike	Sucker	Blackfish	Grayling	Stickleback[1]	Salmon					
													King	Chum	Coho	Sockeye	Pink	
Cape Newenham to Kuskokwim River:																		
Slug River.....	57															x		
Unaluk River....																x		
Salmon River....	13													x		x		
Goodnews River..	1,018	x		x						x			x	x		x		3,800
Indian Creek....	60													x		x		
Cripple Creek...	23													x				
Jack Smith Creek	23													x		x		
No name.....	173			x										x				
Aralik River....	250													x				200
Kanektok River..	752			x						x			x	x	x	x		22,600
Eek River.....	1,102	x	x	x									x	x	x	x		39,300
Kuskokwim River.	22,237	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	698,700
Kuskokwim River to Yukon River:																		
Kugalik River...	258						x		x		x							
Kuguklik River..	381									x		x						
Tooksook River..	113									x		x						
Manopiknak River	290									x								
Azun River.....	315									x								
Aphrewn River...	755									x								
Scammon River...	315									x		x	x	x	x		x	5,100
Yukon River.....	330,000	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	1,000,000
Yukon River to Seward Peninsula:																		
Pastolik River..	146	x		x										x	x	x		300
Pikmiktalik River.....	70	x	x											x	x			
Kogok River.....	82													x				
Golsovia River..	220				x								x	x				
Unalakleet River	1,511	x	x	x			x	x	x		x		x	x	x	x	x	105,600
Egavik Creek	164													x				
Shaktolik Creek.	888	x		x			x						x	x	x		x	39,600
Ungalik River...	756													x				
Inglutalik River	724													x				2,500
Seward Peninsula from Koyuk to Buckland:																		
Koyuk River.....	1,634	x		x			x						x	x	x	x	x	55,600
Kwiniuk River...	189	x		x			x							x	x		x	16,600
Niukluk River...	957	x										x	x	x	x	x	x	35,700

See footnotes at end of table.

Table 2.--Species of fish reported by natives from streams between Cape Newenham and Point Hope, Alaska, and estimates of annual salmon catches--Continued

Area and stream	Square miles drainage area	Species of fish utilized																Recent annual salmon catches
		Whitefish	Sheefish	Dolly Varden	Rainbow trout	Lake trout	Burbot[1]	Pike	Sucker	Blackfish	Grayling	Stickleback[1]	Salmon					
													King	Chum	Coho	Sockeye	Pink	
Seward Peninsula from Koyuk to Buckland--Con.																		
Flambeau River..	252													x	x	x	x	
Nome River.....	390	x		x									x	x	x	x	x	
Sinuk River.....	293													x				
Kuzitrin River..	2,291	x		x			x	x			x		x	x	x	x	x	17,100
Nuluk River.....	220			x												x		
Arctic River....	290	x		x			x							x		x	x	900
Serpentine River	692	x		x			x							x		x	x	
Immacheuk River.	233													x				24,800
Kugruk River....	635	x					x							x				
Kiwalik River...	195													x				3,500
Buckland River..	1,500	x	x	x										x				11,500
Buckland to Point Hope:																		
Kauk River.....	150													x				
Selawik River...	2,500	x	x			x	x	x		x								
Kobuk River.....	11,767	x	x	x		x	x	x	x	x	x		x	x		x		125,000
Noatak River....	19,215	x		x			x	x			x			x				14,400
Kukpuk River....	450	x		x			x				x		x	x				500
Wulick River....	1,200	x		x			x				x			x				600
Total.....																		[2]2,224,200

[1] Burbot reported as "lingcod" by natives; stickleback, as "needlefish."

[2] The total catch figure by river includes the estimated catch for the Yukon River, but does not include salmon caught in salt water. Therefore, the total catch figure given in table 3 does not correspond to the one in table 1 or to the total catch figure for the area.

Source: Raleigh, 1958.

the Kuskokwim was eliminated by a complete closure, but in 1954 restrictions were relaxed to the extent that 3,000 king salmon could be taken commercially below Aniak (fig. 5) and the same number above this village.

In 1960 the Alaska Department of Fish and Game established commercial fishing quotas of 3,000 king and 1,500 coho *(O. kisutch)* salmon below the town of Akiachak (fig. 5) and 1,500 each of king and coho salmon between Akiachak and the mouth of the Aniak River. Changes, which will be effective in 1961, limit catches of king salmon only before August 1. Taking salmon from Akiachak upstream to the middle mouth of Aniak Slough is limited to 1,500 each of king and coho salmon, and similar quotas for the two species

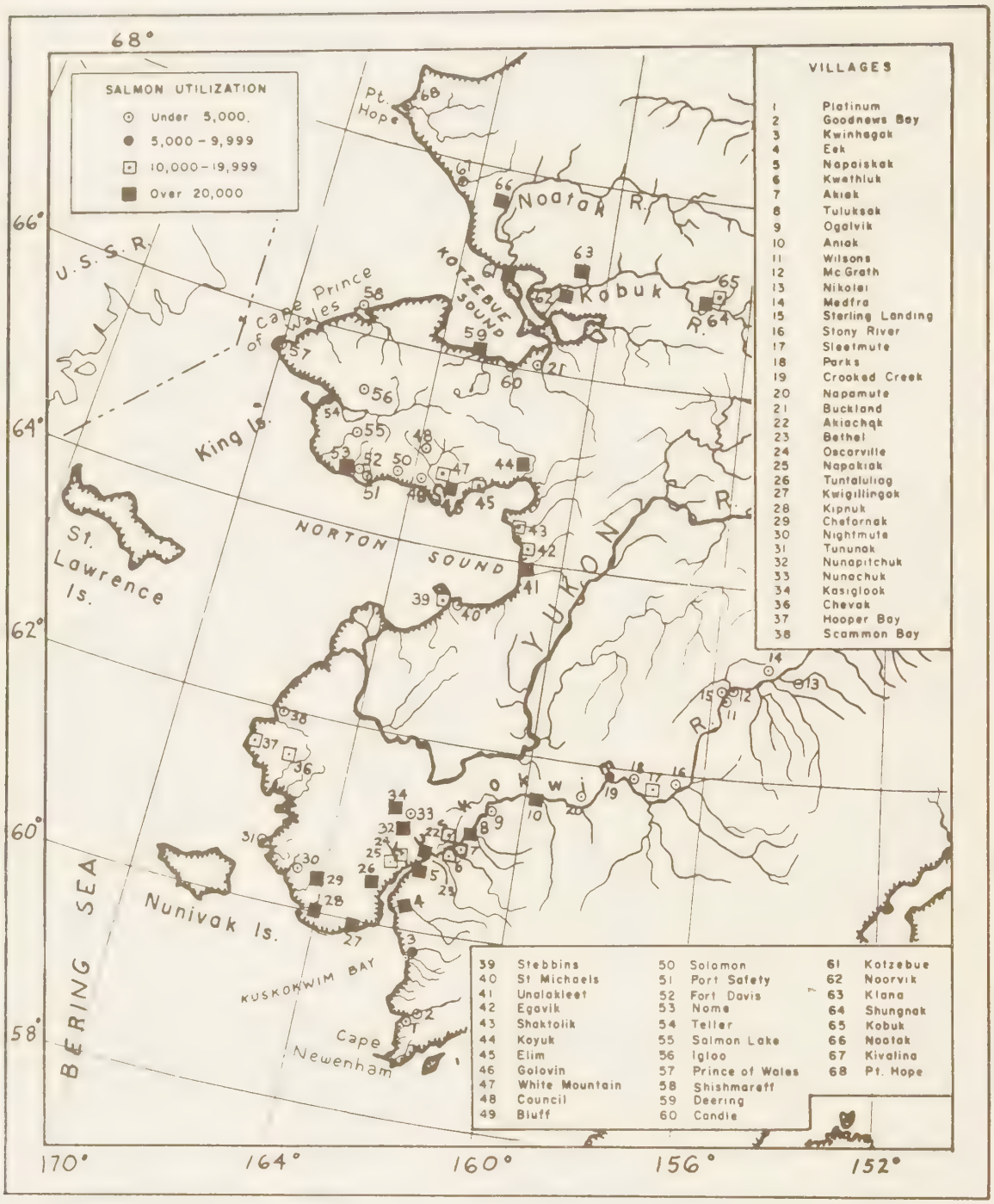

Figure 5.--Villages where estimates of annual average chum salmon catches were made.

were established for the area defined. Although chum salmon may be taken legally for commercial use after August 1, the main runs will have passed the areas of commercial fisheries and thus will have been provided protection until they have reached their spawning areas. Local use for subsistence needs is not affected by the regulations.

Utilization of chum salmon for native subsistence has been rather extensive. L. G. Wingard (Bower, 1923) estimated that 300,000

Table 3.--Importance of chum salmon in food supply of villages, Cape Newenham to Point Hope, 1957

Village and area	Population		Recent average annual chum salmon catch	Rate of village dependency
	People	Dogs		
Cape Newenham to Kuskokwim River:				
Platinum	40	25	40	Low
Goodnews Bay	110	130	1,850	Low
Quinhagak	245	200	9,540	Medium
Eek[1]	175	160	25,440	High
Total for area			36,870	
Kuskokwim River:				
Napaiskak	170	200	26,380	High
Oscarville	40	35	10,000	High
Kwethluk	240	150	16,850	Medium
Akiak	191	200	13,520	Medium
Tuluksak	150	175	48,660	High
Ogalvik	5	8	1,240	High
Aniak	162	340	25,460	Medium
Sleetmute	175	250	35,640	High
Stony River	55	55	4,000	Medium
Wilsons	6	7	1,000	High
Sterling Landing	5	9	1,200	High
McGrath	200	75	500	Low
Medfra-Nikolai	100	175	4,000	Medium
Parks	6	7	1,300	High
Crooked Creek	43	49	7,000	High
Napamute	1	0	200	High
Akiachak	175	300	12,160	Low
Bethel	1,000	250	98,930	High
Napakiak	170	105	15,940	Medium
Nunapitchuk	250	350	23,400	Medium
Nunachuk	7	9	1,400	High
Kasiglook	190	200	28,200	Medium
Eek[2]	175	160	12,720	High
Tuntaluliag	300	400	59,620	High
Kwigillingok[2]	305	350	25,460	Medium
Kipnuk[2]	217	300	20,000	Medium
Chefornak[2]	184	161	17,040	High
Total for area			511,820	
Kuskokwim River to Yukon River:				
Kipnuk[1]	217	300	10,000	Medium
Chefornak[1]	184	161	8,520	High
Nightmute	205	200	30	Low
Tununak	120	175	30	Low
Chevak	250	350	14,480	Low
Hooper Bay	415	116	12,150	Low
Scammon Bay	120	140	2,270	Low
Total for area			47,480	

See footnotes at end of table.

Table 3.--Importance of chum salmon in food supply of villages, Cape Newenham to Point Hope, 1957--Continued

Village and area	Population		Recent average annual chum salmon catch	Rate of village dependency
	People	Dogs		
Yukon River to Seward Peninsula:				
Stebbins	152	127	11,970	Medium
St. Michaels	160	100	5,030	Low
Unalakleet	510	360	34,630	High
Shaktoolik	149	200	15,480	High
Total for area			67,110	
Seward Peninsula Koyuk to Buckland:				
Koyuk	120	200	40,320	High
Elim	120	130	14,300	Medium
Golovin	40	49	7,010	High
White Mountain	128	90	15,920	High
Council	30	20	2,320	High
Bluff	1	7	640	High
Solomon	40	30	1,170	Low
Port Safety	2	10	600	Medium
Fort Davis	40	6	1,680	Medium
Nome	1,500	300	62,300	Medium
Salmon Lake	2	5	1,000	High
Teller	250	150	8,500	Low
Igloo	6	9	1,000	High
Wales	100	30	150	Low
Shishmaref	183	300	170	Low
Deering	110	100	24,780	High
Candle	59	37	3,500	Low
Buckland	114	130	11,500	Medium
Total for area			196,860	
Buckland to Point Hope:				
Kotzebue	650	500	36,520	Low
Noorvik	325	535	61,630	Medium
Kiana	250	400	70,400	High
Kobuk Lake[3]	9	20	3,000	High
Shungnak	175	170	46,680	High
Kobuk	51	80	14,000	High
Noatak	310	375	29,420	Medium
Kivalina	130	125	500	Low
Point Hope	275	250	2,520	Low
Total for area			264,670	
Grand total			1,124,810	

[1] Village listed in correct geographical order, but salmon catch partly or wholly taken in another area.

[2] Village located in a different geographical area, but portion of catch taken from area listed.

[3] Not located on map.

Source: Raleigh, 1958.

chum salmon were dried for human consumption and dog food. Annual estimates of chum salmon taken by local residents were made by agents of the U.S. Bureau of Fisheries for many years. These estimates are given in table 4, as are the numbers of fish wheels and fathoms of nets used in the fisheries from 1922 through 1943. The salmon were reported in tons of dried fish, which have been converted into numbers using a conversion factor of 1.2 pounds of dried salmon to one whole fresh fish. The average annual catch for the period was calculated at 465,700 fish.

In the 1928 annual report of the Alaska fishery and fur-seal industries (Bower, 1929), mention was made of the decline in demand for salmon as dog food, brought about when dogs were replaced by airplanes in transporting fur catches to Fairbanks and Anchorage. Chum salmon continued however to be important in the livelihood of the native residents of the Kuskokwim River area, for some of the largest annual catches were made after 1928 (table 4).

The survey of Raleigh (1958) estimated the recent annual average chum salmon catch at 511,820 (table 3), which compares closely with the calculated average of 465,700 for the period 1922-43. The natives along the Kuskokwim River continue to have a high dependency on salmon. Raleigh found that in the 27 villages surveyed, 15 had a high dependency, 10 a medium, and only 2 a low. He rated the dependency as follows: "The degree of dependency of a village upon the salmon resources was estimated by dividing figures for the total people + (total dogs x 0.7) of the village into the total salmon catch estimate for the village. A village utilizing salmon at a ratio of 100:1 or greater per year on this basis was designated as high, one utilizing salmon at a ratio of from 50 to 99:1 as medium, and less than this as low." The locations of the villages on the Kuskokwim River surveyed by Raleigh are shown in figure 5. The dependency on salmon resources is greatest in villages located along the lower river and least in villages in the upper reaches of the river.

Raleigh further noted the demand for salmon by the natives of the Kuskokwim River system as follows:

From the Territory of Alaska Department of Vital Statistics it was learned that the population of the study area is increasing. Birth and death records for the area from the United States Department of Health, Education and Welfare indicate that a substantial increase in population has occurred since the 1950 census. Also from the same office it was learned that welfare fund payments in the study area have increased steadily in the past five years. Among the factors listed as contributing to the need for welfare aid were inadequate employment opportunities and the occasional failure of the salmon runs to provide enough fish for a winter's food supply. The increasing population, along with the decreased value of furs, has probably made the local people more dependent upon the salmon resources than they previously had been. L. G. Wingard (Bower, 1923) states, "... it seems that the natives of the Kuskokwim River do not depend upon dried salmon for their winter food supply in by any means as large a ratio as do the natives of the Copper River region." In more recent reports there frequently occur notations concerning villages dependent upon the fish resources that have had dog teams starve to death and local people in serious need due to lack of sufficient dried salmon supply to carry them through the winter months. For example: Mrs. Pentecost, principal-teacher for the village of Tuluksak states in her Annual Survey of Native Foods Report (1954), "The food supply for the coming winter is very inadequate. There was a poor run of silver [coho] and dog [chum] salmon .... Some fresh fish will be available during the winter, but the quantities available are usually quite limited and therefore should not be counted as an important source of food supply. The major food is the dried salmon. Last year this was inadequate, and this year there is only about one-half the amount there was last year."

COASTAL AREA FROM KUSKOKWIM TO YUKON RIVER

The coastal area between the mouths of the Kuskokwim and Yukon Rivers is composed of low, flat tundra with a number of small, rather short rivers (fig. 4). Although there are several streams in this area, only one, the Tooksook River, was rated as appearing suitable for salmon according to Raleigh, who made aerial surveys over the larger streams of this area. The majority were muddy tundra streams of dubious value to salmon. Although there is no estimate given for the Aphrewn

Table 4.--Kuskokwim River chum salmon estimated catches and units of gear, 1922-43

Year	Estimated catch		Number of fish wheels	Fathoms of gill nets	Remarks
	Tons	Numbers[1]			
1922		300,000			Estimates made by agent L. G. Wingard.
1923		--			Very light run and poor fishery.
1924	133	221,000			Incomplete data available, no agent on duty.
1925		250,000	57	3,050	Agent stationed on river.
1926	479	798,300	25	6,200	No specific remarks noted in annual report.
1927	186	310,000	16	5,500	Flu epidemic reduced subsistence fishery.
1928	310	516,700	22	4,800	Heavy run, effect of air travel noted on need for dog food for first time.
1929	364	606,700	20	4,100	Heavy runs, best reported by natives in years.
1930	351	584,200	55	12,085	Half of dried fish lost due to spoilage by rains.
1931	253	421,700	38	9,570	Runs lighest in years.
1932	485	808,300	51	7,470	Excellent catch, best in recent years.
1933	282	470,000	38	7,630	Catches below average.
1934	388	646,700	47	10,580	Good catches by natives.
1935	369	615,000	50	6,820	Adequate supplies procured by natives.
1936	357	595,000	46	4,955	Good catches were obtained by local residents.
1937	349	581,700	45	4,900	Reports fragmentary, catches estimated.
1938	243	405,000	47	13,499	Chums reported very abundant, yet catches low.
1939	75	125,000	47	13,000	Very poor runs, no agent present.
1940	257	428,000	47		No agent present, heavy catches reported.
1941	257	428,000	47	13,000	No agent present, catch data based on previous years.
1942	201	335,000	47	8,500	No agent present, catch data estimated.
1943	200	333,300	--	--	No agent present.
Average		465,700			

[1] Data obtained by converting tons of dried salmon into numbers by using a conversion factor of 1.2 pounds of dried fish equal to one salmon (from Knapp, 1958).

Source: Annual reports Alaska fishery and fur-seal industries, 1922-43.

River in table 2, a considerable chum production is indicated by the number utilized at Chevak (table 3), which is located on this stream. Reliable information on the streams was very limited, and many could not be rated for presence of salmon.

Raleigh rated only two of the seven villages as medium or high in dependency upon salmon (table 3). The two villages, Kipnuk and Chefornak, take most of the salmon for their use from the Kuskokwim River. Note that these villages are listed twice in table 3 since they derive a considerable amount of salmon from the Kuskokwim River. The estimated annual chum salmon catch for the region was approximately 47,500.

YUKON RIVER

The Yukon River district is the most important economically for chum salmon of the areas under investigation. The Yukon is one of the largest rivers on the North American continent and has a drainage area of approximately 330,000 square miles. The sources of the system lie in a series of lakes located in southwestern Yukon Territory and northwestern British Columbia in Canada. The river flows in a northwesterly direction from these lakes to Fort Yukon in Alaska and then in a generally southwesterly direction to its mouth, which is on the Bering Sea south of Norton Sound (fig. 1).

In this river system are found all five North American species of Pacific salmon. Chum salmon are the most abundant, followed by king and coho. Sockeye and pink *(Oncorhynchus gorbuscha)* salmon are limited in numbers and are found only in the lower reaches of the river. A limited commercial fishery is allowed principally on king salmon, but all species are used in an extensive subsistence fishery.

The native subsistence fishery extends from the mouth of the Yukon River well up into the Yukon Territory of Canada. Chum salmon are known to ascend the main river as far as the mouth of the Teslin River and then up this tributary to Teslin Crossing (fig. 1).

Chum salmon are extensively utilized for dog food, perhaps even more than for human consumption. The term "dog salmon" may include coho and sockeye salmon, as any salmon (except king and pink) fed to dogs is called by this term.

First commercial utilization of salmon of the Yukon River was reported in 1918 by Bower (1919) as follows: "The development of the Yukon salmon fisheries bagan in 1918 with the establishment of a floating cannery at Andreafski. The season's operations resulted in a pack of 13,463 cases of salmon, divided as follows: Cohos 2,661, chums 6,471, humpbacks [pink] 107, and kings 4,224 cases. In addition to this, 10,400 pounds of cohos and chums were dry-salted. The total catch of salmon for the cannery was 115,531, of which 26,144 were cohos, 73,921 chums, 3,227 humpbacks, and 12,239 kings. Fishing was carried on from the mouth of the Yukon to a point above the junction of Clear River, chiefly in that part of the Yukon delta known as Kwikluak Pass. The fishing seasons were as follows: Kings, June 26 to August 17; chums, June 28 to September 8; humpbacks, July 7 to July 29; and cohos, August 3 to September 8." The Carlisle Packing Co. of Seattle conducted these operations.

In 1919 and 1920 the same company operated a cannery in the Kwiguk Slough. The 1919 operations were quite successful, 101,107 king and 357,081 salmon of smaller species, mainly chum, being processed. However, this was a year in which the salmon runs were well below normal, and fishing conditions, except near the mouth of the river, were extremely poor. As a result, the native subsistence fisheries suffered severely from lack of adequate supplies of salmon. Gilbert and O'Malley (1921) reported the following: "In 1919 the company reported capture of 101,107 king salmon and 357,081 small salmon, largely chums. If these had been captured upriver and dried, the king salmon would then have averaged about five pounds each and the chums 1 1/4 to 1 1/3 pounds. Adopting the lower figure, the cannery pack, dried, would have amounted to 252 tons of king salmon and 223 tons of the smaller varieties, or 475 tons altogether. This is held to be more than twice any possible estimate of the amount of dried salmon actually put up during that season on the entire river."

Fortunately, the 1920 salmon runs were greater than those of 1919, and the cannery operations affected the escapements far less than in the previous year. Gilbert and O'Malley (1921) commented on the conditions as follows:

> In 1920 there was at least a fair average run of the better class, and not improbably it was one of the best runs that can be expected in the Yukon; but the cannery was unsuccessful, owing to adverse fishing conditions. It obtained a little more than half as many kings as in 1919 and less than half as many chums. Had the 58,000 kings and 155,000 chums been permitted to enter the river more salmon undoubtedly would have reached the spawning grounds, but the amount of dried salmon would not have been greatly increased. In the first place the number released would bear a small ratio to the total number running in so good a year; and, furthermore, along that section of the river which put up by far the larger amount of dried salmon, wheels, if operated more than a few hours each day during the height of the run, caught more fish than could be cleaned and prepared for drying. It does not then appear that with a large run of salmon and a relatively small cannery pack the latter has any recognizable effect in lessening the dried salmon supply of the Yukon. We are not prepared, however, to venture the assertion that such would have been the case had the cannery pack in 1920 reached as large proportions as it attained in 1919. But even had the cannery put up the full 60,000 cases in 1920, for which it made preparations, it would not have reproduced the severe conditions which existed on the river in 1919. These, as had been shown, were the result of a phenomenally poor season, made much worse by a large cannery pack.

A public hearing was held in Seattle, November 23, 1920, to consider the advisability of closing all commercial fishing on the Yukon River system. The report of this hearing (Bower, 1921) stated:

> Satisfactory information was presented at that hearing in support of the opinion generally expressed that commercial fishing for export could not be continued without seriously depleting the runs of salmon and jeopardizing the lives of the native inhabitants of the region and their indispensable dogs. Accordingly the Secretary of Commerce issued an order on December 18, 1920, prohibiting the taking of salmon for other than local use from the Yukon River, its tributaries, and the waters within 500 yards of the mouth thereof after August 31, 1921.

Although the Yukon River has been opened for a limited commercial fishery upon king salmon for many years, chum salmon have been protected. The Alaska Department of Fish and Game liberalized the regulations in 1961 to allow for a greater number of salmon to be taken. Prior to August 1, only king salmon can be taken, but after that date chum salmon may be taken legally, as well as king and coho salmon. The latter two have quotas of 5,000 fish each in the area above Owl Slough. By August 1, most chum salmon have migrated through the fishing area and will not be available to the fishery.

The first estimate of the importance of chum salmon in the economy of the Yukon River region was recorded in 1918 (Bower, 1919) as follows: "Statistics compiled at the close of the season of 1918 indicated that exclusive of gear operated by the cannery and salteries near the mouth of the river, the whites and natives on the Yukon and tributary waters used 393 fish wheels, valued at $19,650, and 130 gill nets aggregating 3,250 fathoms, valued at $6,500. The estimated catch for local requirements was 1,400,000 salmon, which when dried represented approximately 700 tons of fish, valued at $140,000." Chum salmon may have made up 90 percent of the total.

Gilbert and O'Malley (1921) evaluated the 1920 Yukon River fishery as follows: "Altogether, on the Yukon and the Tanana, 301 fish wheels were operated in 1920 and resulted in a take of 622 tons. Of this amount 8 percent were king salmon and 92 percent were chums. If an allowance of 100 tons is made for the tributaries not visited and for the later runs on the Yukon which were not seen--and this allowance is almost certainly inadequate--there would be a total provision of dried salmon for the Yukon and its tributaries in 1920 amounting to 722 tons." Based on their estimates stores of dried chum salmon amounted to 650 tons, which would equal 1,083,300 fish, using a conversion factor of 1.2 pounds dried salmon per fish.

Yukon River catches have been compiled from data in the annual reports on Alaska fishery and fur-seal industries for the period 1922-43 (table 5). The annual catches were listed as tons of dried salmon, but these were converted into numbers of fish. The average catch in numbers of chum salmon for this period was 558,800. During this period the numbers of fish wheels fluctuated yearly, but

Table 5.--Yukon River chum salmon estimated catches and units of gear operated for the period 1922-43

Year	Estimated catch		Number of fish wheels	Fathoms of gill nets	Remarks
	Tons	Numbers[1]			
1922	215	358,300			Catch reported smallest in history, poor weather also.
1923	231	464,000			Salmon reported abundant.
1924	735	1,225,000	258	600	Heavy loss due to spoilage.
1925		280,000	168	896	Shortage of salmon and poor fishing conditions prevailed.
1926		602,500	188	769	Fair run of chums reported.
1927		565,800	182	661	Salmon run reported good.
1928	436	726,700	212	911	Catch reported above average.
1929	400	582,500	226	655	Season was fair.
1930	296	492,500	211	925	Chum runs low, poor fishing conditions reduced take.
1931	367	611,700	221	1,022	Chums abundant, reduction noted in demand for dog food.
1932	710	1,183,300	232	1,296	
1933	392	653,300	242	1,668	Lower river runs good, upper river runs low.
1934	308	513,300	215	3,561	Upper river runs light, poor fishing conditions.
1935	349	581,700	247	1,699	Catches near mouth light, better upper river.
1936	324	540,000	251	2,318	Runs irregular, but catches fair.
1937	225	375,000	210	1,311	Light catches due to high river levels.
1938	213	355,000	194	2,100	Chum runs reported unusually heavy, catch light.
1939	126	250,000	204	1,244	Chum quality poor, averaged below 1 lb. dried.
1940	682	1,136,700	222	1,297	Extremely heavy runs and good escapements.
1941	256	383,000	141	3,110	Reduced effort due to defense construction.
1942	128	196,500			Reduced effort, no agent on duty.
1943	130	216,700			Reduced effort, no agent on duty.
Average		558,800	[2] 212	[2] 1,391	

[1] Bulk of data obtained by converting tons of dried salmon into numbers by using a conversion factor of 1.2 lbs. of dried fish equal to one salmon based on data of Knapp (1958).

[2] Averages for period 1924-41, as data for 1922, 1923, 1942, and 1943 were not included in the annual reports.

Source: Annual reports of Alaska fishery and fur-seal industries, 1922-43.

Table 6.--Estimates of total salmon caught for personal use in the Yukon River by districts in 1958

District	Total families fishing	Species of salmon				
		King	Chum	Coho	Pink	Red
No. 1. Yukon River mouth to Mountain Village	149	329	99,563	--	1,050	500
No. 2. Mountain Village through Holy Cross	104	198	60,164	--	1,500	0
No. 3. Holy Cross through Koyukuk	63	57	174,655	--	0	0
No. 4. Koyukuk through Eagle	66	11,306	--	--	0	0
Total	382	11,890	334,382	--	2,550	500

Source: Knapp, 1958.

there was no definite trend. The fathoms of gill nets increased in later years (table 5). These data do not include Canadian catches of salmon, which are unknown for this period.

A recent estimate of the Yukon River salmon catches was made by Knapp (1958) (table 6). (The table does not include 63,666 king salmon, which were taken in the Yukon River commercial fishery.) Chum salmon, with an estimated catch of 334,382 in that year, are the most important species in the extensive personal-use fishery of this river system. The natives, who depend upon salmon for their livelihood, agree that there has been a gradual decrease in the catches of chum salmon.

The amount of fishing gear may be used as an index of fishing effort. The average number of fish wheels used during the period 1924-41 was 212, while in 1956 there were 115 and in 1958, 127. Within the past 2 decades the numbers of fish wheels used annually has been reduced roughly by one-half. On the other hand, the number of gill nets has increased sharply. The 1924-41 average was only 1,391 fathoms, while Knapp's studies recorded a total of 15,475 fathoms. This was the amount registered for gill netting of king salmon during the commercial fishing period, and only 50 fathoms of the total was recorded from the river above Anvik. No report was made of the later use of this gear for chum salmon fishing, but presumably some of it was used.

The fishing effort in Canadian waters of the Yukon River and tributaries is much less than in Alaska. The Branch of River Basin Studies reported the 1955 and 1956 salmon catches of the upper Yukon River (table 7). King salmon outnumbered chum salmon in this region in both years. Interviews with local residents of the Canadian territories definitely indicated a much wider distribution of king than chum salmon. Chum salmon apparently are limited mainly to the main stem of the Yukon River, to the mouth of the Teslin River, and up the Teslin to Teslin Crossing, Yukon Territory, Canada. They also have been reported up the White River to the Donjek River and within the lower Donjek (fig. 1).

Table 7.--Catch of king and chum salmon in the upper Yukon River for the years 1955 and 1956

Location	King salmon		Chum salmon	
	1955[1]	1956	1955[1]	1956
Eagle	1,138	1,163	235	1,939
Moosehide	8	595	136	786
Dawson	1,395	3,651	985	986
Pelly Crossing	819	670	--	--
Fort Selkirk	150	--	700	600
Kirkland Creek	48	40	--	--
Minto	110	17	--	--
Carmacks	410	345	--	--
Total	4,078	6,481	2,056	4,311

[1] Data for 1955 known to be incomplete.

Source: Progress Report No. III, 1956 Field Investigations, Fishery Resources of the upper Yukon River Basin, U.S. Fish and Wildlife Service, Juneau, Alaska, 31 p.

Fishing effort data for the upper Yukon River for 1956 (table 8) show that gill nets are the preferred type of gear, although fish wheels are used to some extent.

YUKON RIVER TO SEWARD PENINSULA

The coastal area extending northward from the mouth of the Yukon River to the mouth of the Unalakleet River contains small streams of limited watersheds which are of minor importance with respect to salmon resources. The Unalakleet, Shaktolik, Ungalik, and Inglutalik Rivers (locations shown in figure 4) are the larger systems (table 2). Raleigh reported catches from all, except the Ungalik River. The Unalakleet River is the major chum salmon stream in this area and is exceeded in importance only by the Yukon, Kuskokwim, and Kobuk Rivers. Pink salmon are also abundant. Knapp estimated a pink salmon escapement in the Unalakleet River of 300,000 to 500,000 in 1958.

Raleigh estimated the annual chum salmon catches in excess of 67,000 (table 3). The villages of Unalakleet and Shaktolik were rated as high on salmon dependency. Stebbins and St. Michael, which are not as advantageously located on productive salmon streams, rated as medium and low respectively.

SEWARD PENINSULA FROM KOYUK TO BUCKLAND

The Seward Peninsula region has, in addition to a large number of small rivers and streams, two rather large river systems, the Koyuk and Kuzitrin, on the Peninsula proper, and the Buckland River entering from the mainland

Table 3.--Number of fishermen operating gill nets and fish wheels in the upper Yukon River basin and the number of humans and dogs partially dependent upon the salmon resources, 1956

Location	Fishermen		Resource-dependent	
	Fish wheel	Gill net	Humans	Dogs
Eagle	3	1	21	15
Moosehide	1	--	7	4
Dawson (area)	5	2	44	23
Stewart River	--	1	([1])	([1])
Kirkman River	--	1	([1])	([1])
Pelly Creek	--	12	39	50
Fort Selkirk	--	1	3	6
Minto	--	([2])	6	4
Carmacks	--	5	24	18
Total	9	25	144	120

[1] Data not available.
[2] An additional four fishermen at Minto could not be contacted.

Source: Progress Report No. III, 1956 Field Investigations, Fishery Resources of the upper Yukon River Basin, U.S. Fish and Wildlife Service, Juneau, Alaska, 31 p.

(fig. 4). Fourteen of the 44 streams in this area have been verified to contain stocks of chum salmon. Six of these have estimated annual catches exceeding 10,000 salmon (table 2). The major streams are the Koyuk, Kwiniuk, Niuklik, Kuzitrin, Immacheuk, and Buckland Rivers. Information was lacking for many of the minor streams, some of which may produce fair runs of fish.

Raleigh estimated the annual chum salmon catches for 18 villages to be approximately 200,000 (table 3). Eight villages were rated as highly dependent on salmon, five as medium, and five as low. He calculated salmon utilization only for the native populations and did not consider the consumption by white residents, which may increase the estimates some. The locations of the villages are shown in figure 5.

BUCKLAND TO POINT HOPE

The area from Buckland to Point Hope contains two major river systems, the Kobuk and Noatak, and four smaller rivers, the Kauk, Selawik, Wulik, and Kukpuk (table 2, fig. 4). In addition, there are some 23 smaller rivers and streams, but these have not been included in the table and figure owing to their minor importance or to the lack of information concerning them. The Kobuk River was rated by Raleigh as being exceeded only by the Yukon

and Kuskokwim Rivers in size of chum salmon catches. More recent information indicates that chum salmon may be in even greater abundance in the Noatak River than in the Kobuk River.

Raleigh estimated that annual catches of chum salmon were in excess of 264,000 for the nine villages listed (table 3). Six of these were rated as having medium to high dependency on salmon resources. This area ranks fourth in utilization of chum salmon, being exceeded by the Yukon and Kuskokwim Rivers and the Bristol Bay area.

OFFSHORE ISLANDS

The offshore islands of the Bering Sea include the Pribilof Islands and St. Mathew, Nunivak, St. Lawrence, Little Diomede, and King Islands. Raleigh estimated 25,000 salmon (species unknown) for Nunivak Island in 1952. Data available for St. Lawrence Island give 800 pink salmon for the village of Gambell in 1955, but the catch for the whole island would be somewhat larger. Data available for King Island give 1,100 salmon (species unknown) for 1950. No estimates have been obtained for the other islands. Salmon resources are limited on most of the islands and generally furnish a minor part of the native livelihood.

SUMMARY

Chum salmon are the most abundant species of salmon in the region north of Bristol Bay. They are present in all of the major and many of the minor streams as far north as Point Hope. Although their distribution is known to extend north and east to the Mackenzie River, reliable information on abundance and escapements is lacking in many cases.

The Yukon River system has a resident subsistence fishery that utilizes approximately 500,000 to 1,000,000 chum salmon annually. Chum salmon are known to ascend the river as far as Teslin Crossing, Canada, on the Teslin River.

The Kuskokwim River system ranks second in importance with regard to chum salmon utilization. Recent estimates of annual subsistence fisheries indicate catches in excess of 511,000.

The Bristol Bay area ranks third in importance with respect to utilization of this species. The commercial catch alone ranges from 150,000 to as high as 400,000. The subsistence fishery utilizes a large number of salmon in addition to those used in the commercial pack.

The area from Seward Peninsula to Point Hope is fourth in utilization of this species with an estimated annual catch in excess of 264,000 fish. The Kobuk River is the major salmon stream in this area.

Chum salmon catches from the various coastal areas, excluding Bristol Bay and the Kuskokwim and Yukon Rivers, may range up to 200,000 fish annually, with the largest catches in the Seward Peninsula area and the smallest in the area from Cape Newenham to the Kuskokwim River. Salmon catches, including all species, for the Bering Sea Islands are of minor importance and form a small portion of the native's diet.

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